



# Rosetta Program Update

prepared for *MAFA 2007*

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# What is New?

- LANSCE data for Virtex 5 (65 nm)
- Rosetta News:
  - More atmospheric data for VII, VII Pro, S3, V4, V5!
  - Almost one year “in the ground” at Rustrel with zero measured alpha upsets
  - XC5VLX110 arrays operating in France
- Beam News:
  - Re-activation of 3S1500 210Po
  - More neutron beam facilities evaluated

# Virtex 5 at LANSCE

- After three recent visits
  - Configuration:  $6.16\text{E-}15$
  - BRAM:  $3.83\text{E-}14$
- V5 cross sections with respect to V4:
  - Configuration: x 2.34 smaller
  - BRAM: x 1.17 larger
- Using V4 Rosetta to predict V5 upset rates
  - Configuration: 31 FIT/Mb
  - BRAM: 52 FIT/Mb

# V5 Rosetta Arrays

- On-line in San Jose, 400 units >150,000 operating hours, 1 config hit, 1 BRAM hit
- All V5 arrays off to France, some to Rustrel, others to the mountain tops
- No plans to populate the White Mountain site as it is effectively off line

# The Rosetta (SEU) Stone

<u>Node</u>	<u>Family</u>	<u>LANSCE/Config</u>	<u>LANSCE/BRAM</u>	<u>Rosetta/Config(1)</u>	<u>Rosetta/BRAM(1)</u>
250nm	Virtex	9.90E-15	9.90E-15	158 FIT/Mb	158 FIT/Mb
180nm	Virtex E	1.12E-14	1.12E-15	179 FIT/Mb	179 FIT/Mb
150nm	Virtex II	2.50E-14	2.64E-14	399 FIT/Mb	376 FIT/Mb
130nm	Virtex II Pro/Pro-X	2.74E-14	3.91E-14	389 FIT/Mb	628 FIT/Mb
90nm	Spartan 3	2.40E-14	3.48E-14	174 FIT/Mb	585 FIT/Mb
90nm	Spartan 3E/3A	1.31E-14	2.73E-14	96 FIT/Mb	459 FIT/Mb
90nm	Virtex 4	1.55E-14	2.74E-14	99 FIT/Mb	111 FIT/Mb
65nm	Virtex 5	6.67E-15	3.96E-14	43 FIT/Mb	160 FIT/Mb

Notes:

Error estimates for each Rosetta measurement:

150nm +/- 9.3%, 130nm +/- 12.4%, 90nm S3 -67% +134%, 90 nm S3E -90% +150%, 90nm V4 - 38% +51%, 65nm -50% +75%, 65nm data from LANSCE  
95% confidence interval

# Rustrel

- Underground facility now ready for new arrays
- Two arrays of 100 each 2VP50
  - Configuration: ~ 59 FIT/Mb (1 upsets)
  - BRAM: <187 FIT/Mb (0 upsets)
  - Effectively, there is no alpha source in these parts
  - One year of data
- Virtex 5 went to Rustrel 6 months ago (6-11-2007), currently zero upsets

# Mostly Mountains

- With a “0” reference, no longer need sea level
- All experiments are moving to “high places”
- Longmont, Colorado (three arrays)
- Albuquerque, New Mexico (three arrays)
- Mauna Kea, Hawaii (three arrays)
- Pic du Bure, France (two arrays 2VP50)
- Pic du Midi, France (TBD)
- Aiguille du Midi, France (TBD)
- White Mountain, California has no power (off-line)

# Simulation News

- Much work is occurring in this area:
  - L2MP (France)
  - Sandia Labs
  - Vanderbilt
- No good correlation at this time
- Have three test chips with data to study:
  - 90nm
  - 65nm
  - 45nm

# Beam News

- A Xilinx customer made extensive tests of Virtex II (for beam calibration) and evaluated Virtex 4 at the TSL facility in Sweden
- ISIS facility tested Virtex II to evaluate this site
- We now have consistent results on Virtex II for
  - LANSCE
  - TRIUMF
  - TSL
  - ISIS
- Po-210 re-activation experiment was successful at the LANSCE site

# LANSCE

- All visits, Six 2V6000's per visit as calibration of beam metrology and energy distribution
  - Configuration:  $2.57E-14$
  - BRAM:  $2.78E-14$
- Variation from visit to visit
  - -9%, +4% (all sources of errors)
- IRoC/Actel Test of 2V6000 (one part, one visit)
  - Configuration:  $4.2E-14$  (-26%, +30%)

# TRIUMF

- Extremely difficult to use as only one part may be irradiated at a time
- Energy Spectrum unique
- Decision is “do not use”
  - Today’s technology is too robust
  - Need to test large numbers of arrays
  - Statistical significance of data required
  - Beam calibrator will be required in next JESD89

# Customer's tests at TSL

- Data collected at 20 MeV, 50 MeV, 100 MeV, 180 MeV (quasi-monoenergetic)
- Allowed for the determination of needed  $Q_{crit}$  for ICDES
- “Calibrated” TSL quasi-monoenergetic beam methods against LANSCE white source
- 20, 50, 100, 180 MeV + “weighting factors”
  - Configuration:  $2.41E-14$  to  $4.97E-14$
  - Use of complex weighting results in variance
  - Difficult to compare results (Xilinx' opinion)

# ISIS

- One Visit, with 'golden' 2V6000s
  - Configuration:  $2.57E-14^*$
  - BRAM:  $2.54E-14^*$
  - +/-5% from number of events
  - +/-2.5% Flux error
- \* "Calibration Factor" used to compare with LANSCE
- Shows great promise as a test facility due to superior metrology – need more data
- Additional runs with 65 and 90 nm product underway as well as with Virtex II 'calibrators' in progress
- Supporting ISIS in request to expand exposure facility

# Re-activation of $^{210}\text{Po}$ @ LANSCE

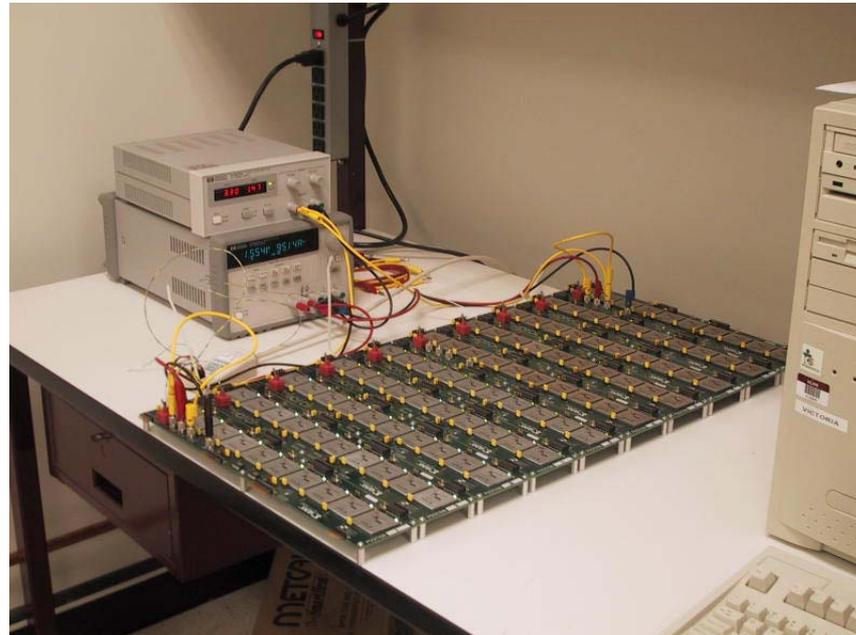
- 3S1500 parts suspected of having  $^{210}\text{Po}$  contamination
- 'Classic' 138.4 day  $\frac{1}{2}$  life signature
- Irradiated at LANSCE:  $12.81\text{E}10$  neutrons
- 95% confidence interval
  - Configuration: 495 to 7144 FIT/Mb
- Un-irradiated 3S1500 (same 95% c.i.)
  - Configuration: 35 to 199 FIT/Mb
- $^{210}\text{Po}$  was (is) present in this lot
- Looking for potential cause(s)
- Increase of  $\sim 20$  X in FIT rate...decreasing by  $\frac{1}{2}$  every 138.4 days

# Beam Testing Conclusions

- Identical setups, results are +/-20% (or worse)
- Still must do atmospheric testing as calibrator
- Must do alpha package testing, alpha rates too low to be differentiated by altitude data
- 210Po source audits (air ionizers) should not be used in any wafer fab or assembly facility
- 210Po fab audit for Fab2 complete, Fab1 in progress
  - Phosphoric acids used Fab1 have been implicated as probable 210Po source
  - Fab1 using same acids supplier as Fab2 for last two years

# **Atmospheric Neutron Testing Sites in use by Xilinx**

# San Jose

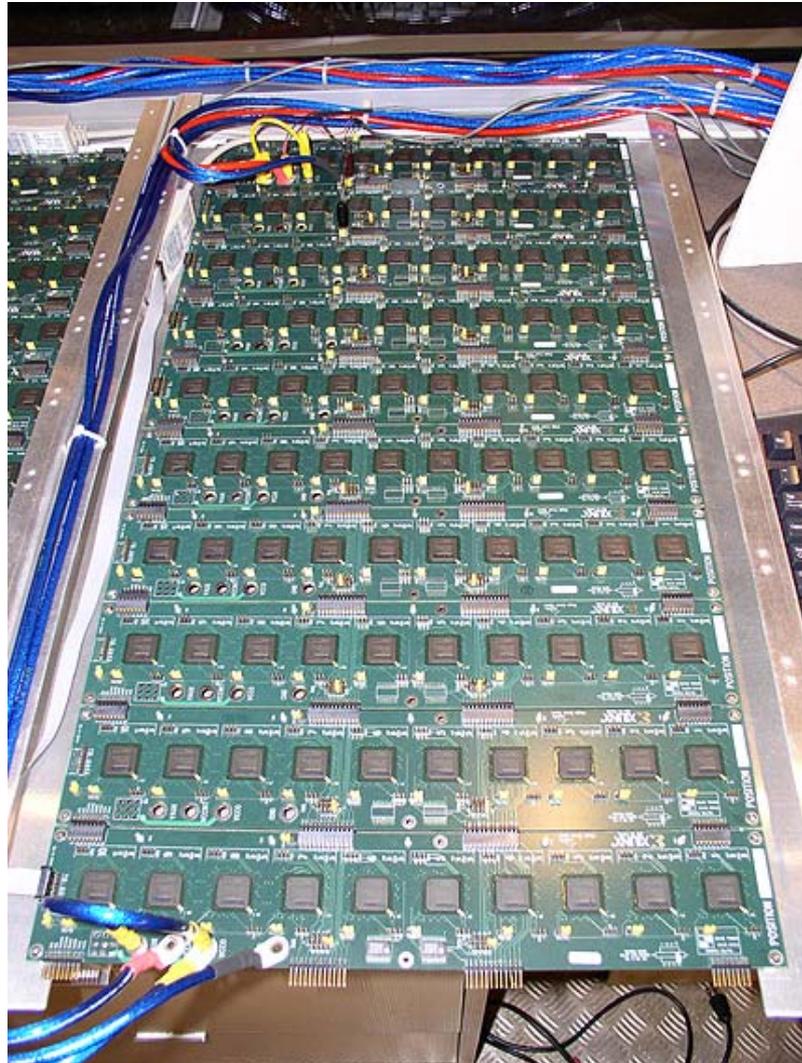


One of 8 arrays in San Jose

# Satellite View, XSJ



# Albuquerque, NM



One of three  
arrays in  
Albuquerque

# Satellite View, XNM



Three arrays:

2V6000

XC4VLX25

XC4VLX60

# Longmont, Colorado



Xilinx

3100 Logic Dr.

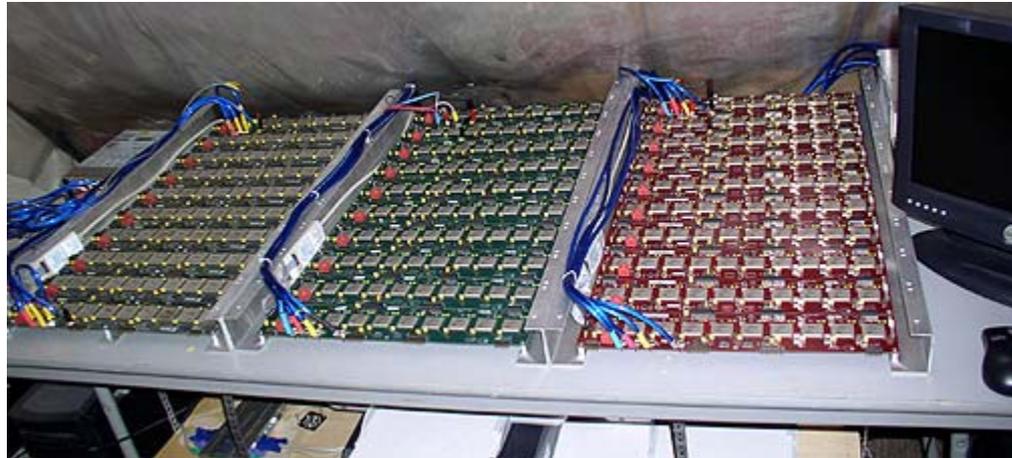
Longmont, Co

Three arrays:

XC4VLX60

2-XC4VLX25

# White Mountain

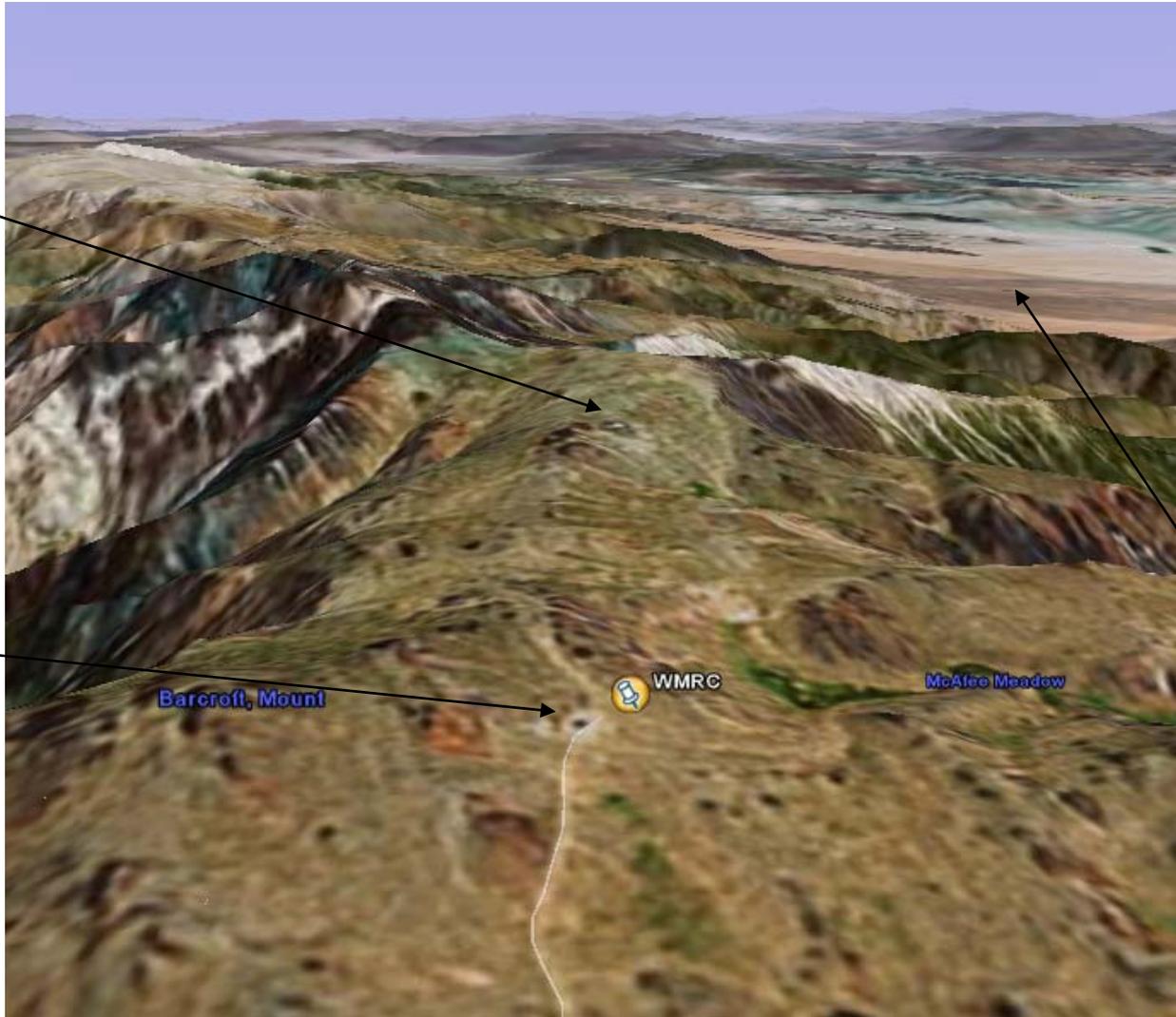


The three arrays at White Mountain, recently removed

# Satellite View, WMRC

Summit:  
Radio to  
Bishop,  
California

Arrays  
were here:



Off-line:  
Lost power  
cable to  
summit for  
web radio link

Nevada  
desert

# Mauna Kea

## Caltech Submillimeter Observatory Reference Page



The Leighton Telescope.  
Photo courtesy of Mark Halpern and Scott Chapman

### CSO Instruments

**Heterodyne Receivers** (Existing and New Balanced Receiver Development)  
**SHARC II** (Submillimeter High Angular Resolution Camera)  
**Bolocam**  
**DSOS** (Dish Surface Optimization System)  
**CSO Beam Efficiency Measurements**  
**CSO-JCMT Interferometer**

### Weather Information



current summit views

### CSO Information

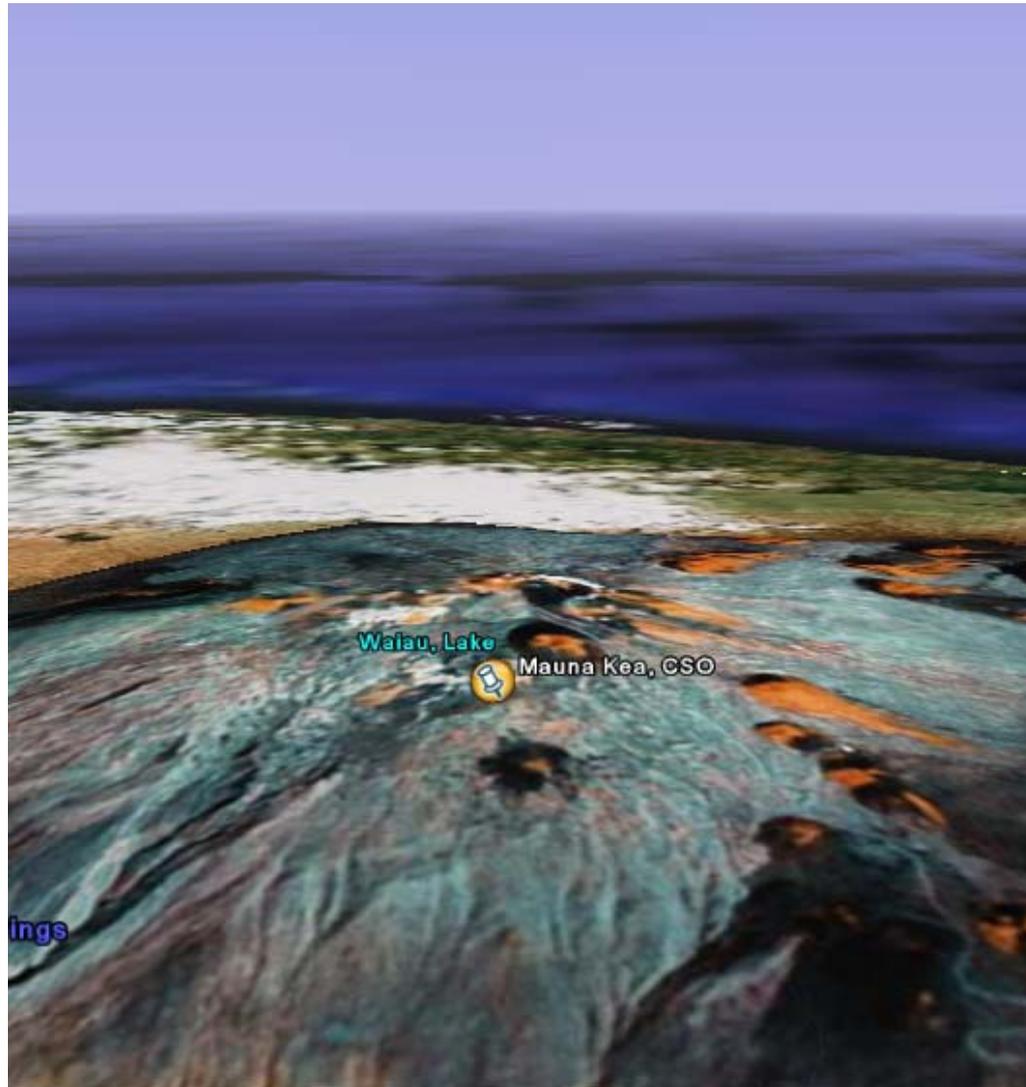
**General Information**  
**Local Information** (Memos, Trouble Shooting Guide, etc.) *For Current Observers*  
**Logistics** *For Current And Incoming Observers*  
**CSO Observing Manual** (revised Jan. 2002)  
[in gzipped PostScript: for **Letter** or **A4** (7.7 MB)]  
[in PDF format: for **Letter** or **A4** (5.4 MB)]  
**Recent CSO Results**  
**Live Image from the CSO**  
**Information about the CSO antenna and optics**  
**CSO Education, Outreach, and Public Service**  
**CSO Hawaii Based Staff**  
**Employment Opportunities**

[CSO Weather Page](#)

[CSO Weather Log](#)

One array of 100 90nm Spartan 3 parts

# Satellite View, MK



Arrays:

3S1500

2V6000

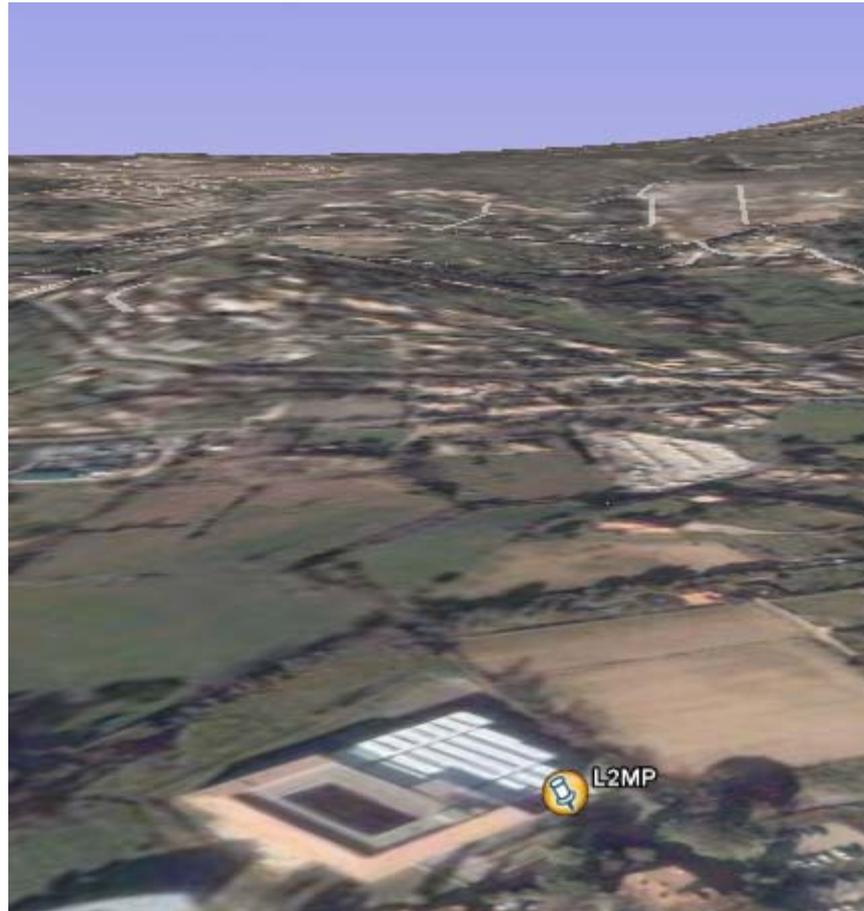
XC4VLX60

# L2MP



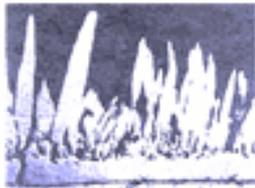
Two arrays at the University in Marseille

# Satellite View, L2MP



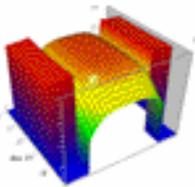
- Laboratory for **M**aterials and **M**icroelectronics of **P**rovence (L2MP)
- Joint Research Unit CNRS/Universities implanted in Marseille and Toulon
- 2 departments: Nanosciences, Microelectronics & Nanoelectronics
- Staff: 210 (including 90 PhD and post-docs)
- Research activities:
  - “microelectronics and nanotechnologies, including modeling, design, architecture, processes, materials and their physico-chemical properties”

Research is performed inside *two departments* and *nine teams* :



#### **MATERIALS AND NANOSCIENCES DEPARTMENT**

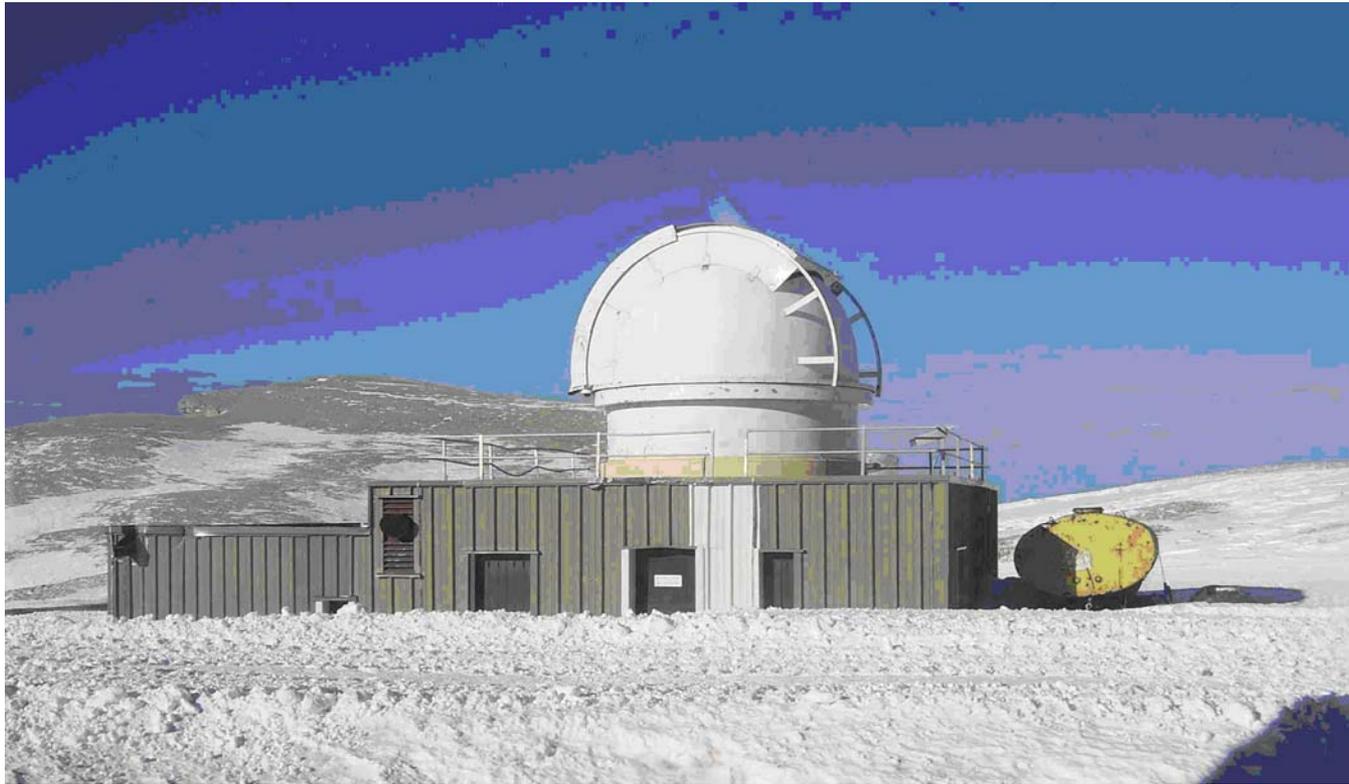
- Interfacial reactivity and diffusion (team manager: Claire Bergman)
- Self-organized micro and nanostructures (team manager : Bernard Billia)
- Magnetism (team manager : Anatoli Stepanov)
- Nanostructuration (team manager : Louis Porte)
- Theory, modelling and numerical simulation (team manager : Jean-Marc Debierre)



#### **MICRO- AND NANO-ELECTRONICS DEPARTMENT**

- Ultimate silicon devices (team manager: Jean-Luc Autran)
- Memories (team manager: Pierre Masson and Rachid Bouchakour)
- Design (team manager : Hervé Barthélemy)
- Microsensors (team manager : Khalifa Aguir)

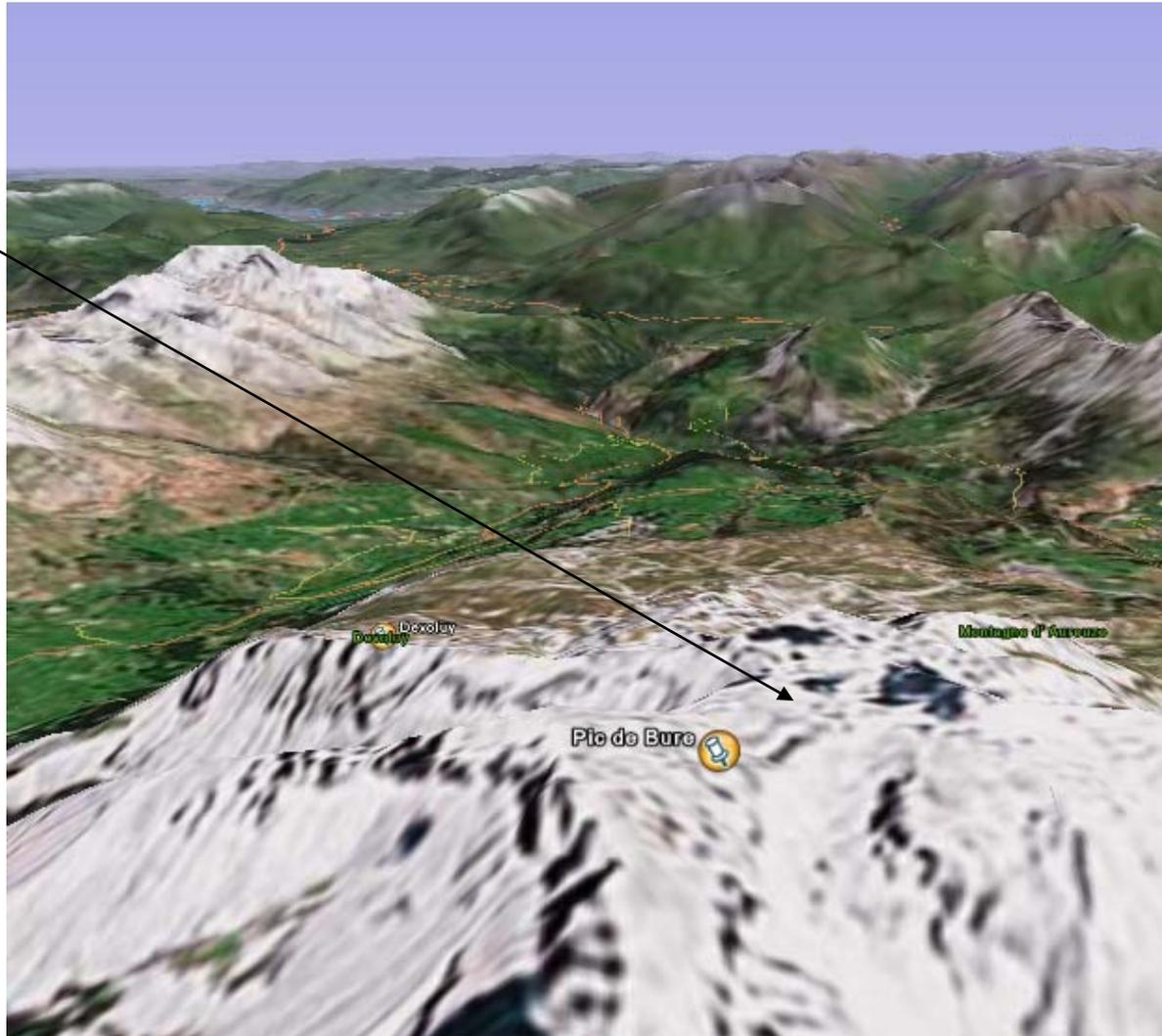
# Pic de Bure



As part of ASTEP, there are two arrays here

# Satellite View, Pic de Bure

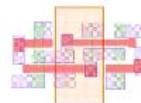
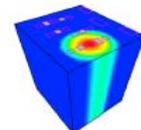
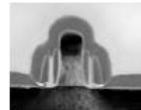
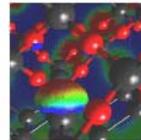
Building



# ASTEP

## Altitude SEE Test European Platform (ASTEP)

Operated by CNRS-L2MP (UMR 6137 – Marseille)  
In collaboration with STMicroelectronics and JB-R&D



### ASTEP

Institut de Radioastronomie Millimétrique (IRAM)  
Bâtiment POM2 – Plateau du Pic de Bure (alt. 2552m)  
F-05250 Saint-Etienne en Dévoluy – France

With the financial support of  
Conseil Général des Hautes Alpes  
Conseil Régional Provence Alpes Côte d'Azur  
Commission Européenne (fonds FEDER)  
Centre National de la Recherche Scientifique  
Université de Provence (Aix-Marseille 1)  
Institut Universitaire de France

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13384 Marseille Cedex 13 - France



NEW! Press releases :

[Electronique International Hebdo](#), n° 618, 12 Jan 2006

[Dauphiné Libéré](#), 14 Dec 2005

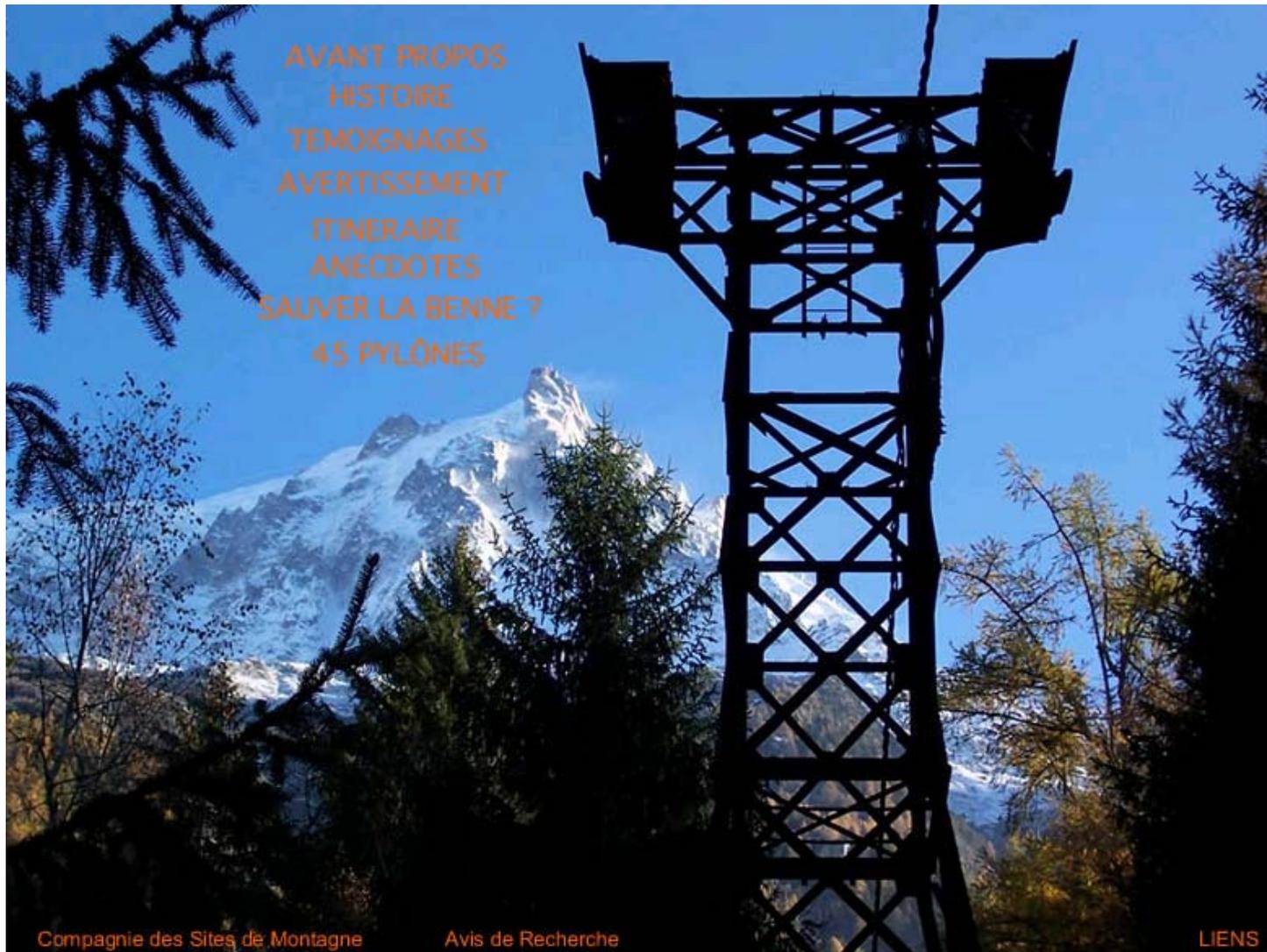
[La Provence](#), 14 Dec 2005

# Pic du Midi

Arrays at  
base of  
antenna  
building:  
TBD



# Aiguille du Midi



Arrays:  
TBD

# Rustrel



<http://www.inseet.com/home/index.html>

At 550 meters below the peak of the mountain overhead, this is a reference “0” activity site for testing for alphas in packaging on two arrays

Email: [christophe.sudre@inseet.com](mailto:christophe.sudre@inseet.com) for site details

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## Notre Actualité:

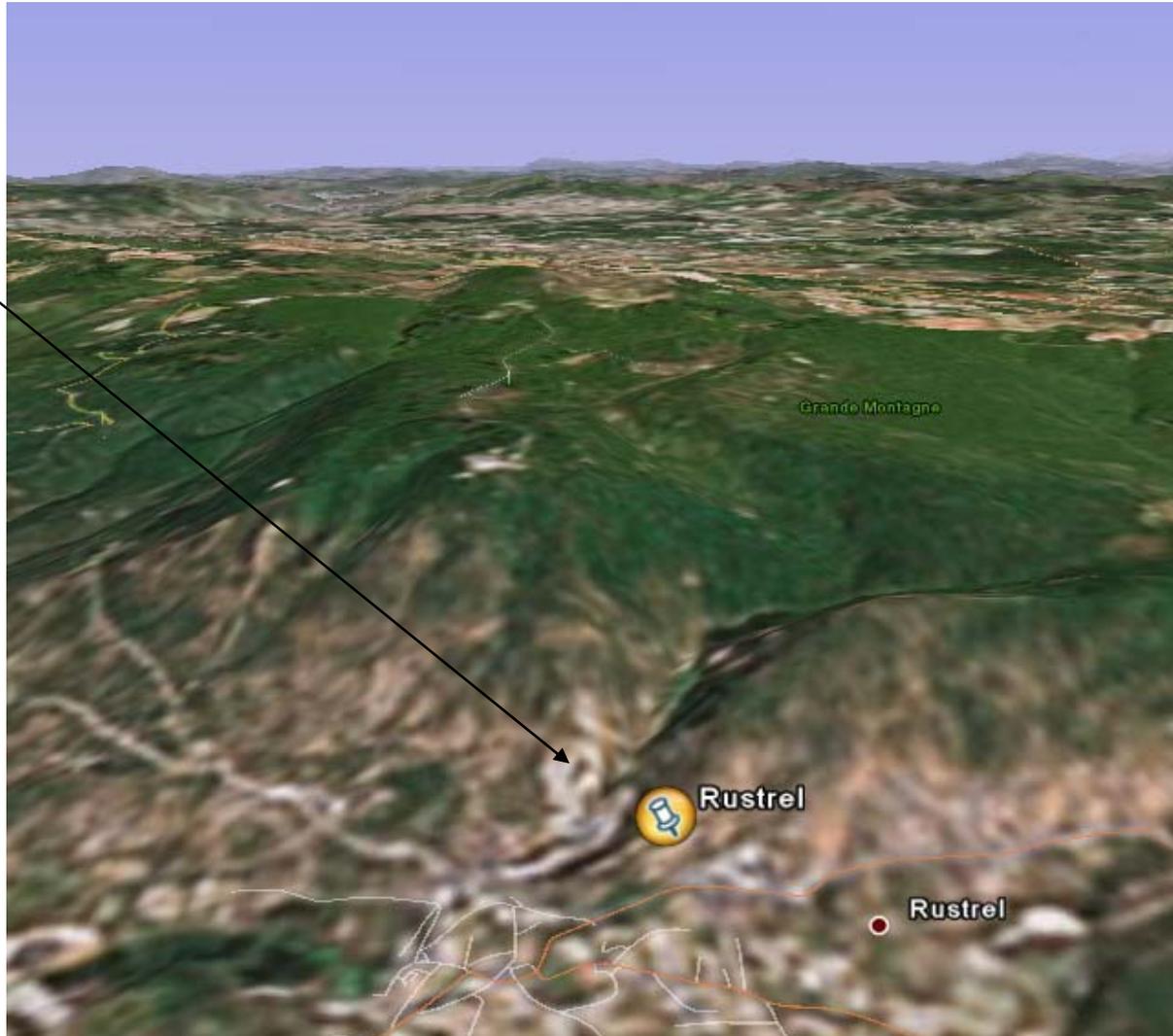


Le Laboratoire Matériaux et Microélectronique de Provence (L2MP, unité mixte de recherche du CNRS n° 6137 des Universités Aix-Marseille I, III et de Sud-Toulon Var) et la société XILINX (San José, Californie) ont procédé, courant février 2006, à l'installation d'une plateforme multi sites de caractérisation de composants microélectroniques en région Provence Alpes Côte d'Azur.

Trois sites ont été choisis pour accueillir cette expérience internationale, baptisée « *Expérience Rosetta* » :

- ❖ la Technopôle de Château-Gombert à Marseille, lieu d'implantation du L2MP,
- ❖ L'Institut de Radioastronomie Millimétrique (IRAM), sur le plateau du Pic de Bure à 2552m d'altitude
- ❖ le Laboratoire Souterrain Bas Bruit de Rustrel-Pays d'Apt (LSBB, Université de Nice Sophia-Antipolis) à -550m sous la roche du plateau d'Albion.

# Satellite View, Rustrel



Entrance &  
Parking  
Lot



# Xilinx would like to thank:

- *This work has benefited from the use of the Los Alamos Neutron Science Center at the Los Alamos National Laboratory. This facility is funded by the US Department of Energy under Contract W-7405-ENG-36.*
- *California Institute of Technology Sub millimeter Observatory at Mauna Kea, Hawaii operated by California Institute of Technology (CALTECH)*
- *White Mountain Research Station at White Mountain, California operated by the University of California Office of Research in San Diego, California.*
- *The ICDES staff of the APD, Xilinx, San Jose for their hard work and creative design solutions.*
- *ASTEP and our hosts: Prof. Jean-Luc Autran, Karine Castellani, L2MP, Marseille*
- *INSEET: Christophe Sudre, Rustrel, and our host: Prof. Georges Waysand, Université de Nice Sophia-Antipolis*
- *University of Toulouse and Pic du Midi*
- *University of Nice and Aiguille du Midi*